普傑國際股份有限公司

Operational Manual

RGM-3000/REB-3000 Series

Operational Manual

Version 1.8
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Professor GPS Module: RGM-3000/REB-3000 series Operational Manual

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Professor GPS Module: RGM-3000/REB-3000 series

Operational Manual

Introduction

RGM-3000/REB-3000 series is the third generation of Professor GPS Receiver. The GPS receiver is powered by SiRF Star II technology and Professor proprietary navigation algorithm that providing you more stable navigation data. The miniature design is the best choice to be embedded in a portable device like PDA, mobile phone, person locator and vehicle locator. It supports TricklePower function which can be enabled by external command for power saving. The excellent sensitivity of RGM-3000 gets the great performance when going though the urban canyon and foliage.

RGM/REB-3000 Configuration Select Table

RGM/REB	Power Config	I/O Connector	Switch Cable	Ext ANT	F/W Version	F/W Configuration
	1	2	3	4	5	6
REB-3000	N: Normal L: Low Power	F:FFC P:Pin type	1:SMA 0:None	2.Hirose 0:None	1.Enhanced	1.GGA,GSA,RMC,GSV,4800 (GSV:5 sec/time, others: 1Hz)
RGM-3000	N: Normal L :Low Power	F:FFC P:Pin Type	0:None	0: None	1.Enhanced	1.GGA,GSA,RMC,GSV,4800 (GSV:5 sec/time, others: 1Hz)

Product Features

RGM/REB-3000XXXXXX

- ✧ OEM product development is fully supported through applications engineering and WEB technique forum.
- ✧ Small form factor.
- ✧ 12 parallel channels
- ✧ 0.1 second re-acquisition time.
- ✧ Enhanced algorithm for navigation stability.
- ✧ NMEA-0183 compliant protocol/custom protocol.
- ✧ WAAS demodulator
- ✧ Excellent sensitive for urban canyon and foliage environments.
- ✧ Single satellite positioning.
- ✧ Dual multi path rejection.

Product applications

RGM-3000/REB-3000

- ✧ Portable IA device for personal navigation/ position commerce (P-Commerce)
- ✧ Automotive applications
- ✧ Personal positioning and navigation
- ✧ Marine navigation
- ✧ Timing application
- ✧ **Extendable I/O capability – Provides programming I/O function and development tool kit for customer**

Product models

RGM-3000LXXXXX/REB-3000LXXXXX

Adopt the latest SIRF low power chips (GSP 2e-LP and GRF 2e-LP). Power consumption can be lowered ro 80mA.

RGM-3000NXXXXX/REB-3000NXXXXX

Adopt the SIRF standard chips (GSP 2e and GRF 2e). Power consumption is 180mA

RGM-3000XFXXXX/REB-3000XFXXXX

RGM/REB-3000 with FPC type I/O connector.(22 pins,)

RGM-3000XPXXXX/REB-3000XPXXXX

RGM/REB-3000 with Pin type I/O connector.(20 pins)

RGM-3000XX00XX

The RGM-3000 is a stamp size GPS receiver with a patch antenna on top of GPS receiver.

REB-3000XXXXXX

REB-3000 provides the external antenna power (2.8DCV ± 5%) through RF cable. There are 3 models for versatile applications:

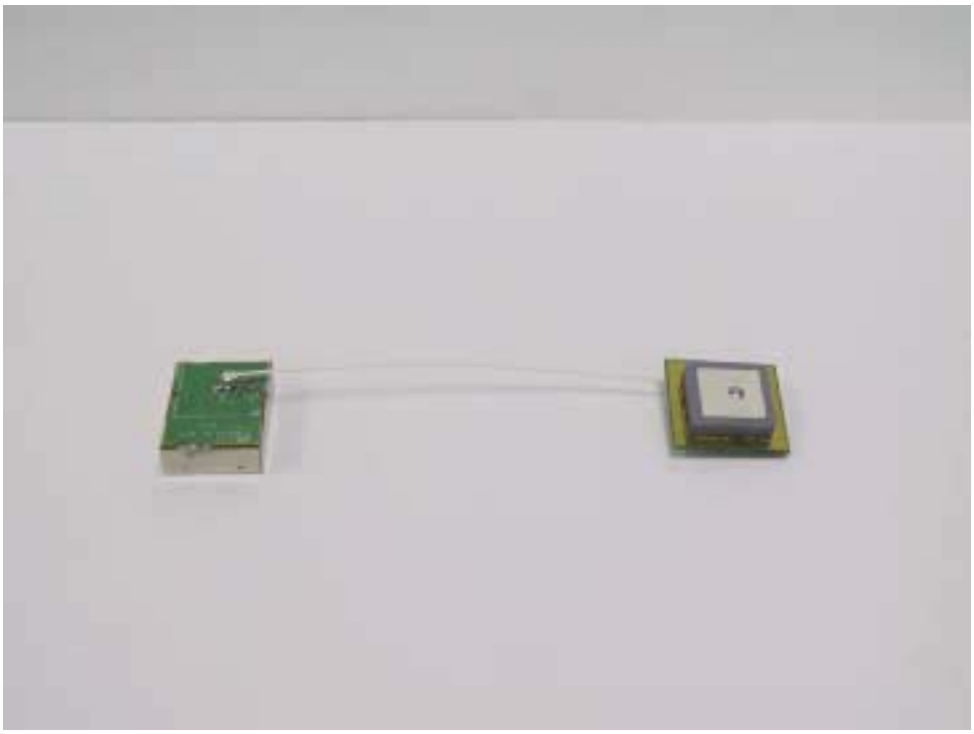
1) REB-3000XX10XX: with SMA RF cable.

2) REB-3000XX02XX: with 100 mm RF cable and a patch antenna.(RF cable can be customized)

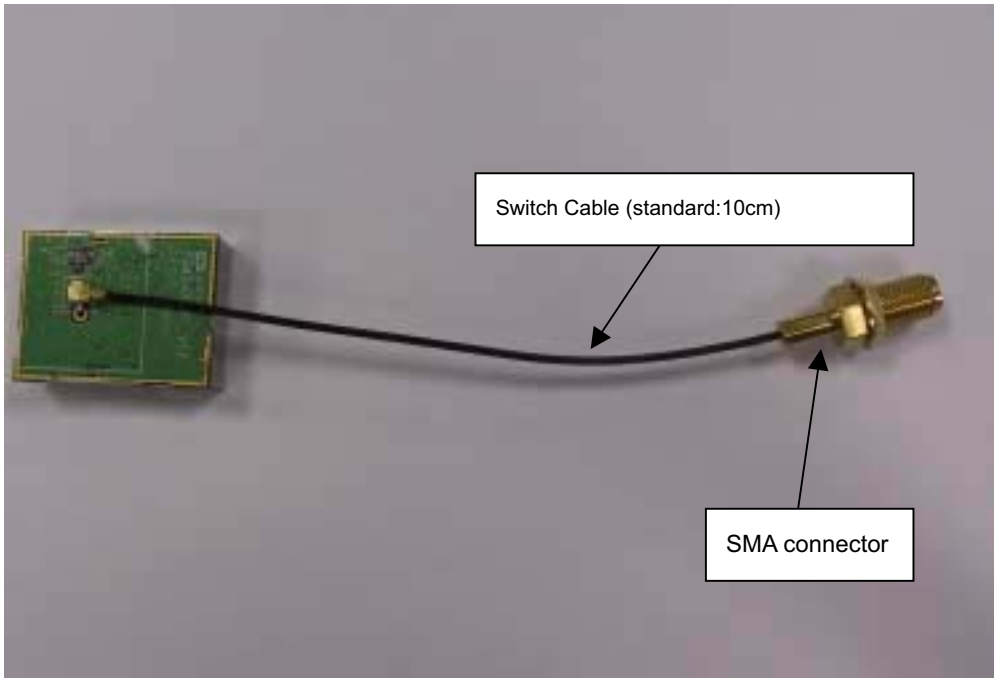
3) REB-3000XX00XX: GPS receiver core module only

Picture

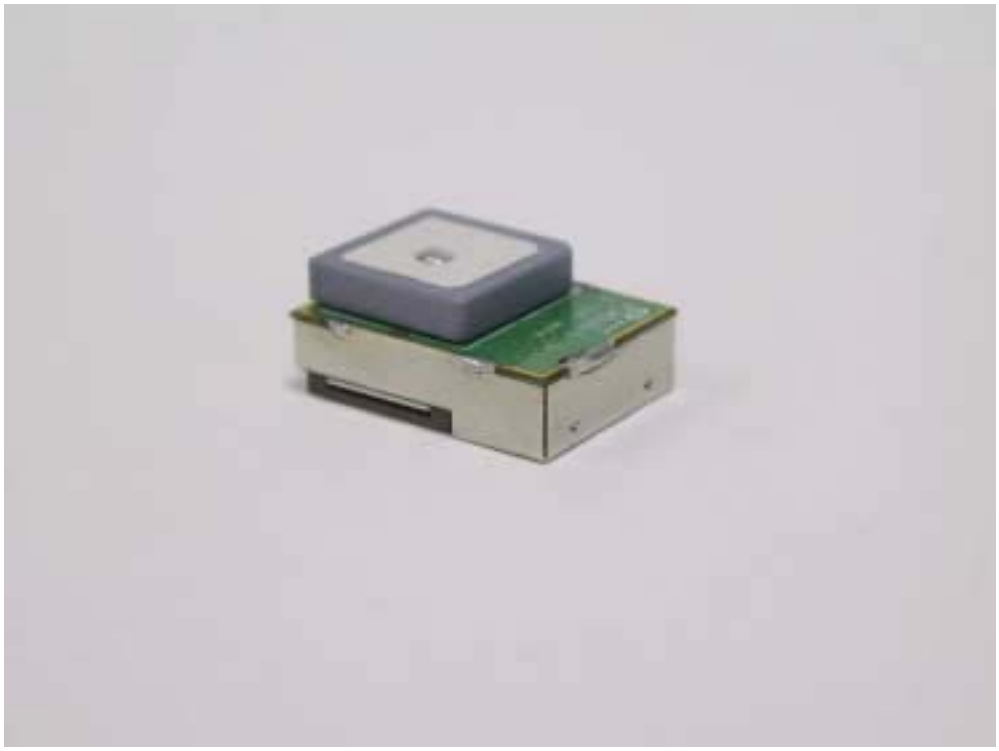
REB-3000XX02XX



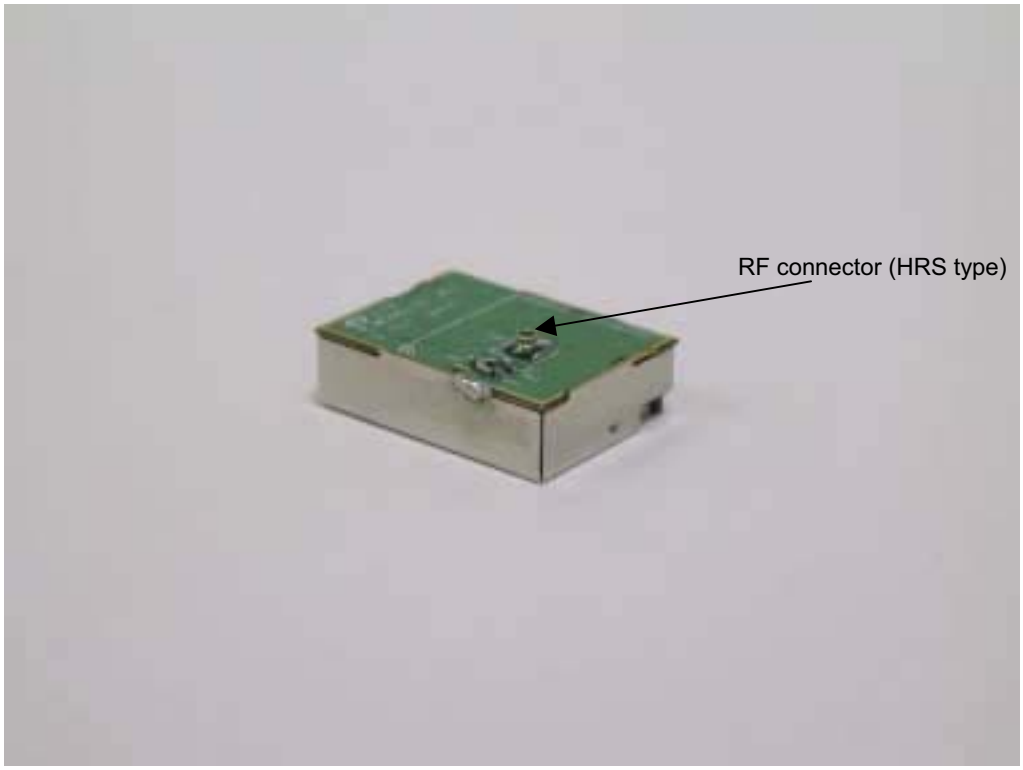
REB-3000XX10XX



RGM-3000XX00XX



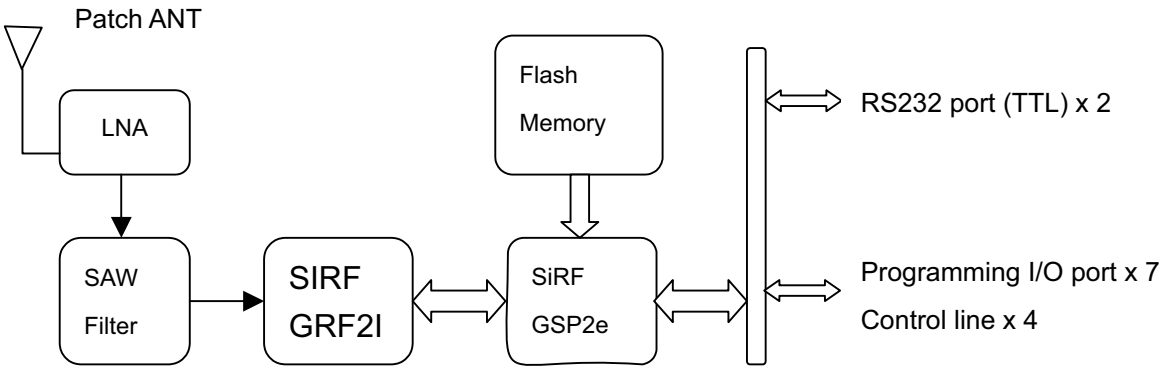
REB-3000XX00XX



RGM-3000/REB-3000 Series System Block Diagram

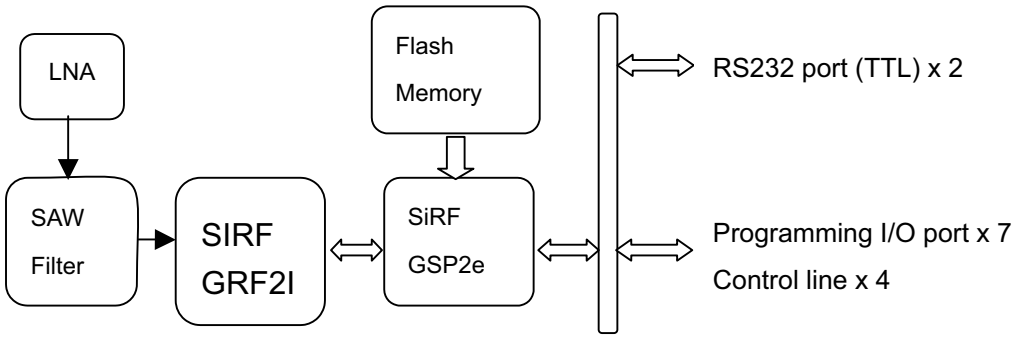
The RGM-3000/REB-3000 series consists of SiRF star II chipsets technology, Professor LNA and proprietary software. The system is described as follows.

RGM-3000XX00XX/REB-3000XX01XX



REB-3000XX10XX/REB-3000XX00XX

GPS.receiver w/o patch ANT.



Technique specifications

RGM-3000/REB-3000 series.

Operational Characteristics.

12 Channels

L1, 1575.42MHz.

C / A code, 1.023MHz chip rate.

Snap start: 3 seconds, 90%

Hot start: 8 seconds, 90%

Warm start: 38 seconds, 90%

Cold start: 48 seconds, 90%

Reacquisition:0.1 second, typical

Navigation update rate: Once per second.

Datum: WGS-84.

Accuracy.

Position accuracy: ≦ 25m CEP without SA

Velocity accuracy:0.1 meters/second without SA

DGPS Accuracy.

Position:1 to 5 m, typical

Velocity: 0.05 meters/second, typical

DGPS type

WAAS, EGNOS, RTCM-104 protocol.

Dynamics.

Altitude: 18000 meters (60000 feet) Max.

Velocity: 515 meters / second Max.

Acceleration: 4 g. , Max.

Power Requirements.

The input voltage is 3.3V±10%, ripple ≦ 200mV. The power of active antenna is supplied by RGM-3000/REB-3000 series.

REB-3000LXXXXX/RGM-3000LXXXXX

Current ≦80mA typical

≦100mA max.

(3.3volt, w/o ext antenna)

REB-3000NXXXXX/RGM-3000NXXXXX

Current ≦180mA typical

≦200mA max.

(3.3volt, w/o ext antenna)

Weight. 30g(RGM-3000),15g(REB-3000)

Environment.

Temperature.

Operating temperature -40 ~ +85 Degree (Celsius).

Storage temperature: -50 ~ +100 Degree (Celsius).

Humidity ≦95% noncondensing.

GPS Antenna Specification(REB-3000XX02XX, RGM-3000XX00XX)

Center Frequency: 1575.42±1.023MHz

Bandwidth (-10dB return loss):≧8MHz

Gain at Zenith: 3.0dBi Typ, ≧2dB;

Gain at 10° elevation :-1.0 dBi Typ,≧−4dB

Polarization :R.H.C.P

Axial Ratio : 2.0dB max

LNA Specification:(External ANT for RGM-3000XX02XX)

Center Frequency: 1575.42±1.023MHz

Gain : ≧12dB

Noise Figure : ≦3dB

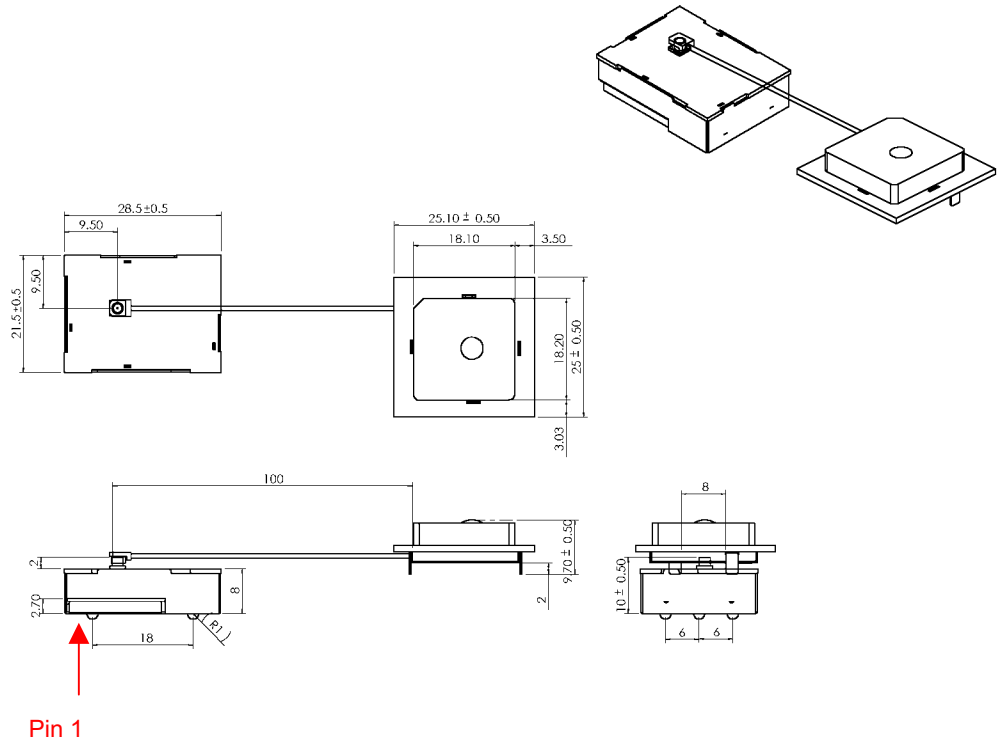
Out Band Attenuation : 7dB min for ±20MHz
20dB min for ±50MHz
30dB min for ±100MHz

Output V.S.W.R	2.0dB max
Voltage	DC 3.0v±10%
Current	≦15mA

Mechanical Layout

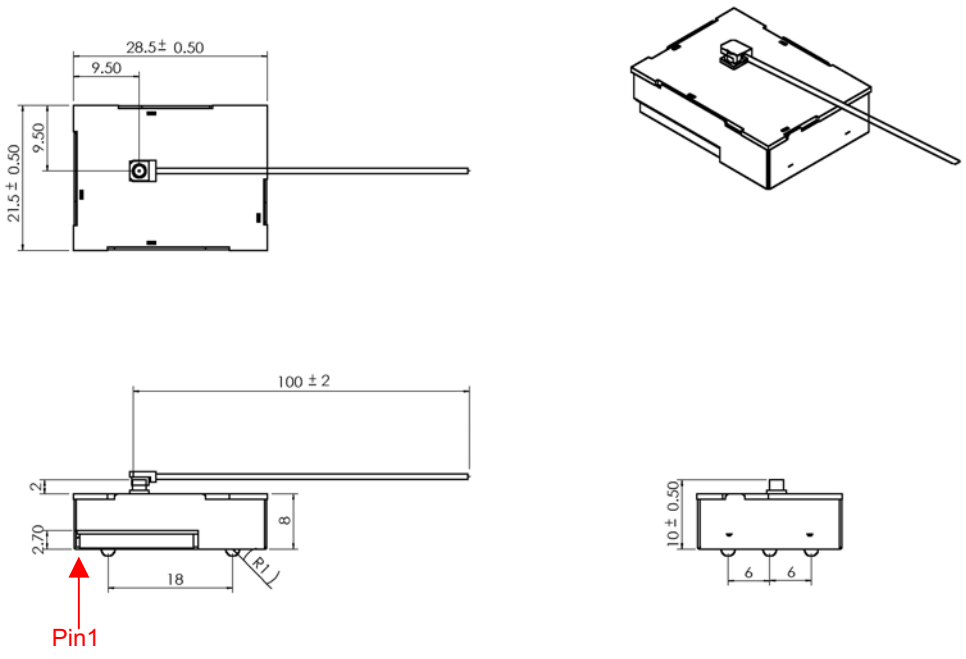
RGM-3000/REB-3000 Mechanical Layout

REB-3000XF02XX (FPC Type)



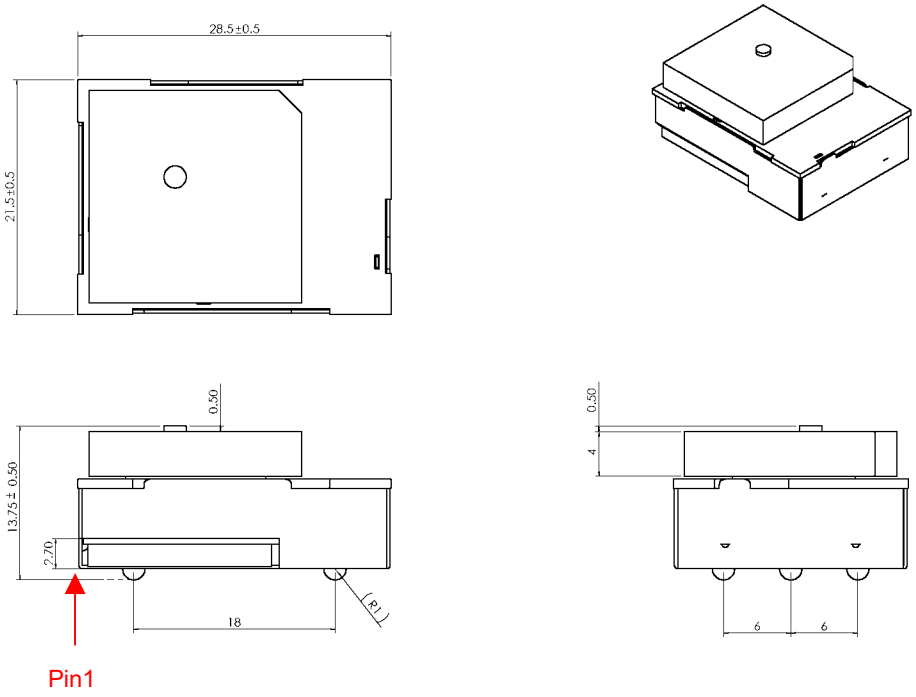
Pin 1

REB-3000XF10XX (FPC Type)

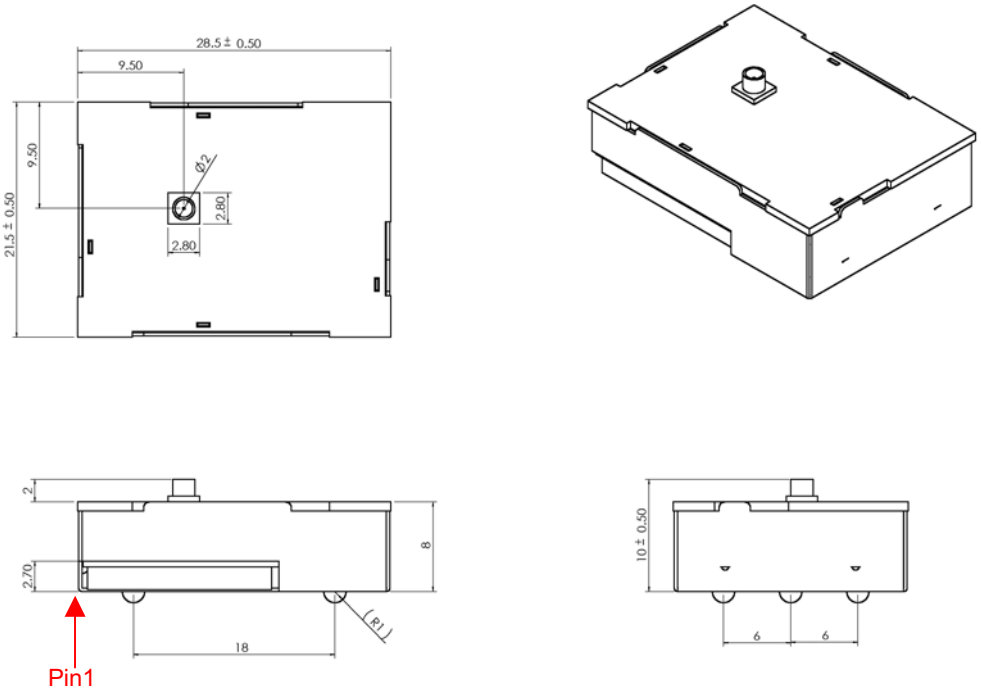


Pin1

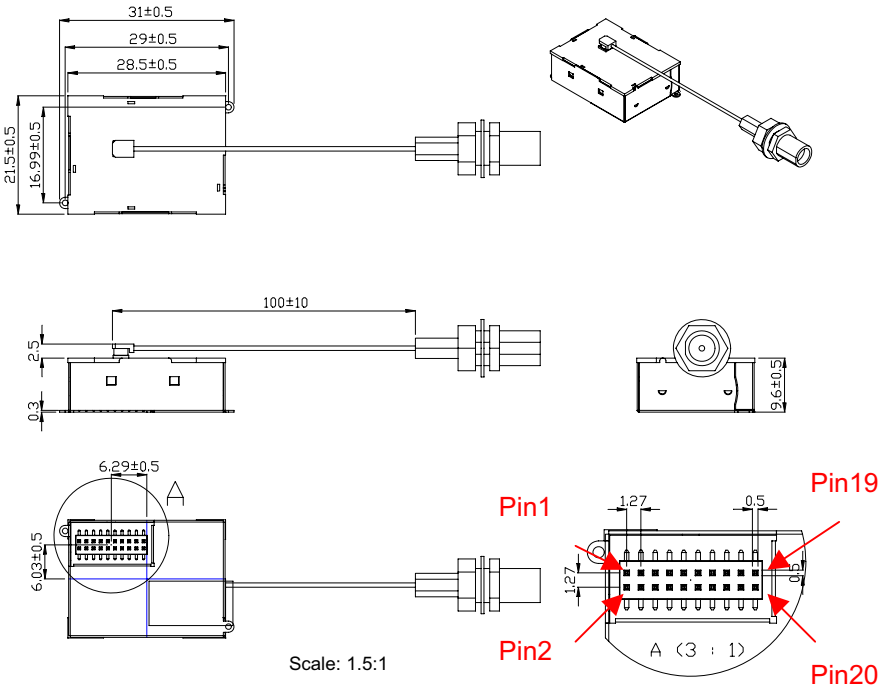
RGM-3000XF00XX (FPC Type)



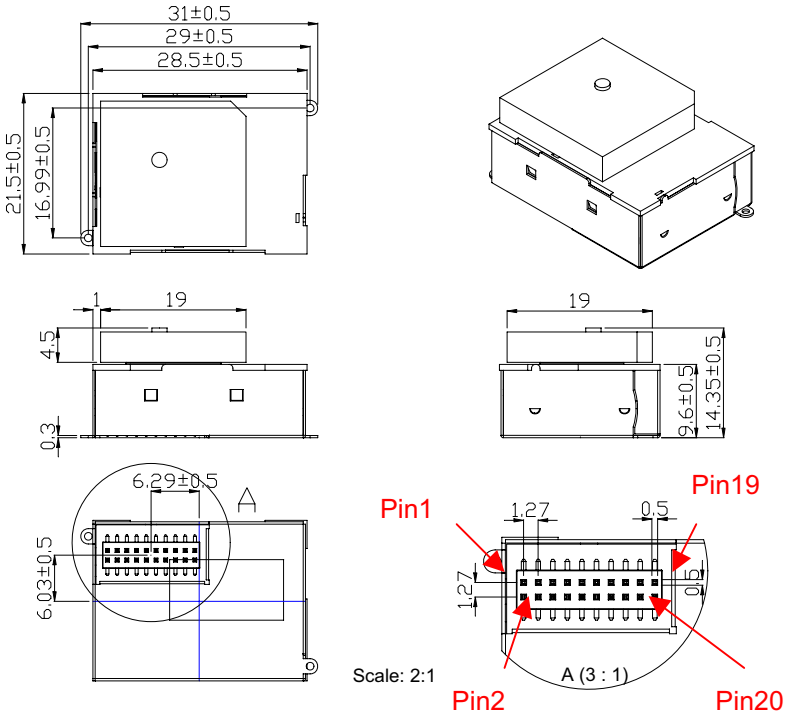
REB-3000XX00XX (FPC Type)



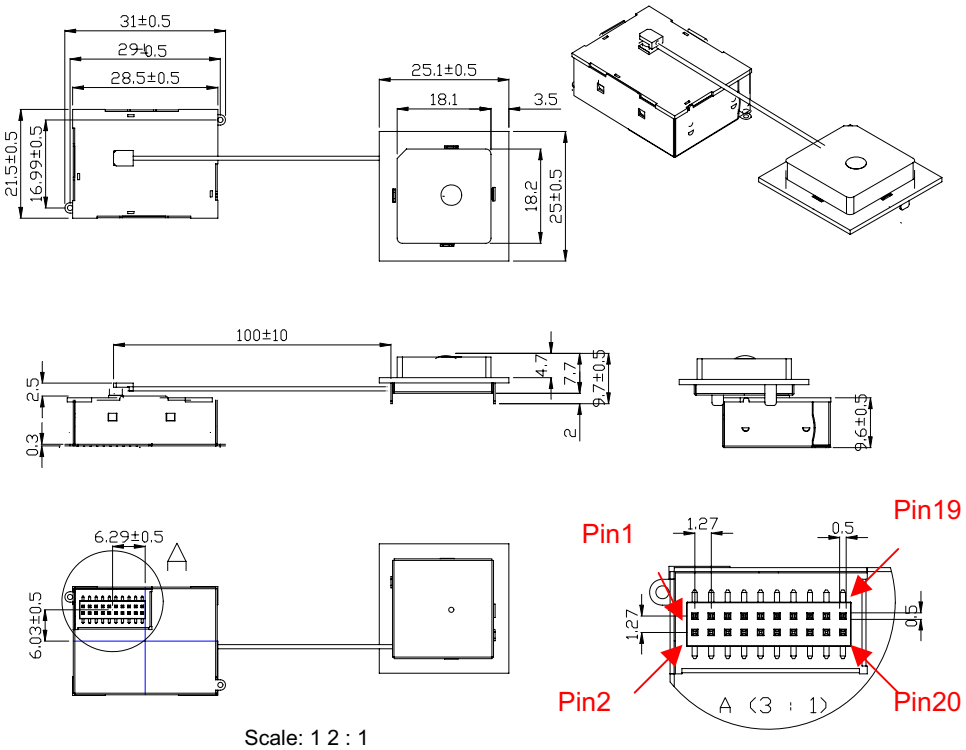
REB-3000XP10XX (Pin Type)



RGM-3000XP00XX (Pin Type)

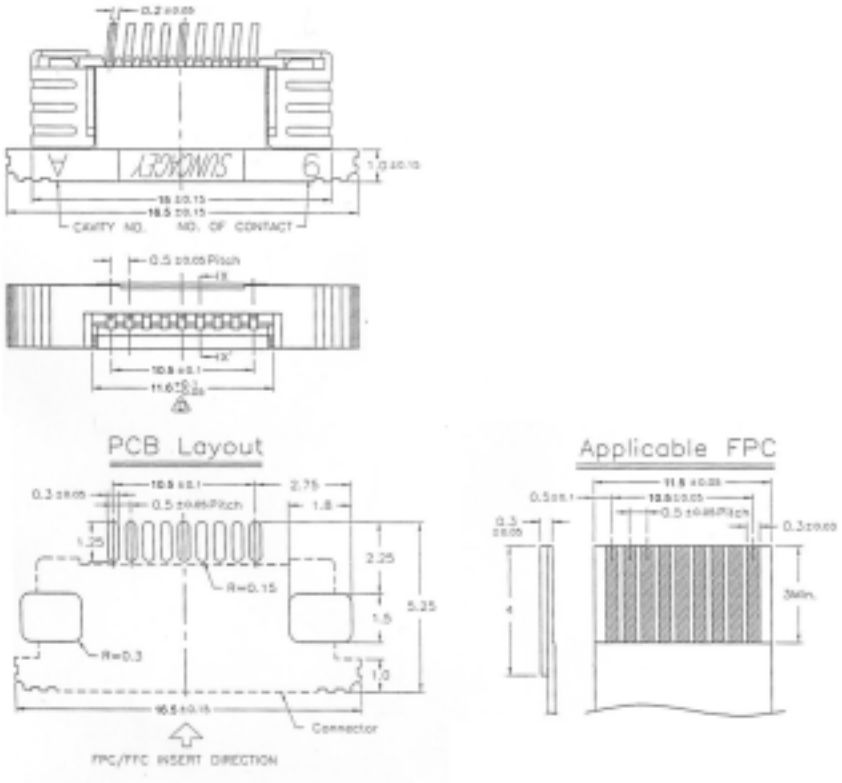


REB-3000XP02XX (Pin Type)

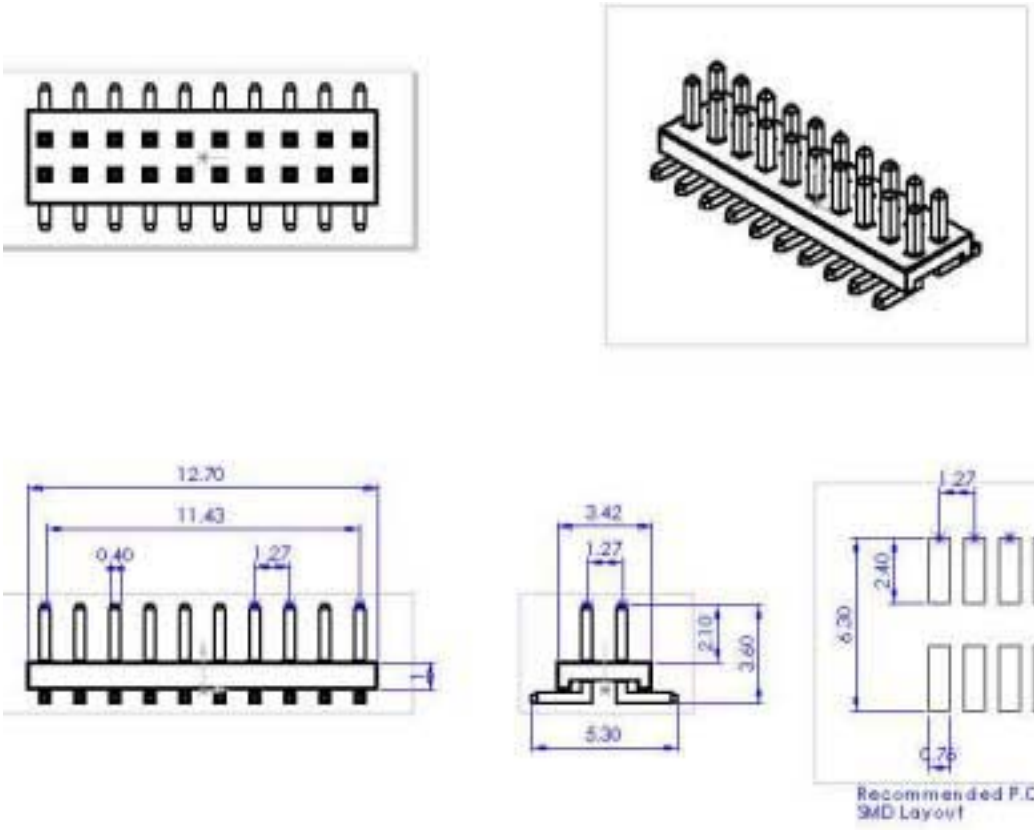


Scale: 1 2 : 1

Dimension for Flexible Flat Circuit & Connector



Dimension for Pin type Connector(male and female):



Hardware interface

RGM-3000XFXXXX/REB-3000XFXXXX (FPC Type).

Connector Type：FPC, 22 Pin

Pin NO	Name	I/O	Description	Characteristic
1	VCC		System Power	DC 3.3V ± 10% (Suggested: add an external bypass capacitor. Value ≧ 2.2uF)
2	VCC		System Power	DC 3.3V ± 10% (Suggested: add an external bypass capacitor. Value ≧ 2.2uF)
3	TXA	O	Navigation Data Output	TTL Level；Voh≧2.4V, Vol≦0.4V；Ioh=Iol=2mA
4	RXA	I	Serial Data Input	TTL Level；Vih≧0.7*VCC；Vil≦0.3*VCC
5	TXB	O	Reserved	TTL Level；Voh≧2.4V, Vol≦0.4V；Ioh=Iol=2mA
6	RXB	I	RTCM 104 Differential GPS Input	TTL Level；Vih≧0.7*VCC；Vil≦0.3*VCC
7	TIMEMARK	O	1 Pulse per second time mark Output	Vil≦0.2V, Pulse Width≧10ms
8	Reserved		Not Used	No connection
9	BOOTSEL	I	Internal boot, Active High	TTL Level；Vih≧0.7*VCC；Vil≦0.3*VCC
10	Reserved	I	Reserved	
11	VBAT		External Backup Power Input	2.1V≦ Vbat ≦3.6V
12	RESERVED			
13	GPIO3	I/O	General Purpose I/O Pin	TTL Level； Output：Voh≧2.4V, Vol≦0.4V；Ioh=Iol=2mA Input：Vih≧0.7*VCC；Vil≦0.3*VCC
14	GPIO5	I/O	General Purpose I/O Pin	TTL Level； Output：Voh≧2.4V, Vol≦0.4V；Ioh=Iol=2mA Input：Vih≧0.7*VCC；Vil≦0.3*VCC
15	GPIO6	I/O	General Purpose I/O Pin	TTL Level； Output：Voh≧2.4V, Vol≦0.4V；Ioh=Iol=2mA Input：Vih≧0.7*VCC；Vil≦0.3*VCC
16	GPIO7	I/O	General Purpose I/O Pin	TTL Level； Output：Voh≧2.4V, Vol≦0.4V；Ioh=Iol=2mA Input：Vih≧0.7*VCC；Vil≦0.3*VCC
17	GPIO10	I/O	General Purpose I/O Pin	TTL Level； Output：Voh≧2.4V, Vol≦0.4V；Ioh=Iol=2mA Input：Vih≧0.7*VCC；Vil≦0.3*VCC
18	GPIO13	I/O	General Purpose I/O Pin	TTL Level； Output：Voh≧2.4V, Vol≦0.4V；Ioh=Iol=2mA Input：Vih≧0.7*VCC；Vil≦0.3*VCC
19	GPIO15	I/O	General Purpose I/O Pin	TTL Level； Output：Voh≧2.4V, Vol≦0.4V；Ioh=Iol=2mA Input：Vih≧0.7*VCC；Vil≦0.3*VCC
20	GND		System GND	
21	GND		System GND	
22	GND		System GND	

RGM-3000XPXXXX/REB-3000XPXXXX (PIN Type)

Connector Type：20 Pin Header，1.27 mm pitch

Pin NO	Name	I/O	Description	Characteristic
1	VCC		System Power	DC 3.3V ± 10% (Suggested: add an external bypass capacitor. Value ≧ 2.2uF)
2	VCC		System Power	DC 3.3V ± 10% (Suggested: add an external bypass capacitor. Value ≧ 2.2uF)
3	GND		System GND	
4	GND		System GND	
5	RXA	I	Serial Data Input	TTL Level；Vih≧0.7*VCC；Vil≦0.3*VCC
6	TXA	O	Navigation Data Output	TTL Level；Voh≧2.4V, Vol≦0.4V；Ioh=Iol=2mA
7	RXB	I	RTCM 104 Differential GPS Input	TTL Level；Vih≧0.7*VCC；Vil≦0.3*VCC
8	TXB	O	Serial Data Output	TTL Level；Voh≧2.4V, Vol≦0.4V；Ioh=Iol=2mA
9	BOOTSEL	I	Internal boot, Active High	TTL Level；Vih≧0.7*VCC；Vil≦0.3*VCC
10	Reserved		Not used	No connection
11	VBAT		External Backup Power Input	2.1V≦ Vbat ≦3.6V
12	Reserved		Not Used	No connection
13	GPIO3	I/O	General Purpose I/O Pin	TTL Level； Output：Voh≧2.4V, Vol≦0.4V；Ioh=Iol=2mA Input：Vih≧0.7*VCC；Vil≦0.3*VCC
14	TIMEMARK	O	1 Pulse per second time mark Output	Vil≦0.2V, Pulse Width≧10ms
15	GPIO6	I/O	General Purpose I/O Pin	TTL Level； Output：Voh≧2.4V, Vol≦0.4V；Ioh=Iol=2mA Input：Vih≧0.7*VCC；Vil≦0.3*VCC
16	GPIO5	I/O	General Purpose I/O Pin	TTL Level； Output：Voh≧2.4V, Vol≦0.4V；Ioh=Iol=2mA Input：Vih≧0.7*VCC；Vil≦0.3*VCC
17	GPIO10	I/O	General Purpose I/O Pin	TTL Level； Output：Voh≧2.4V, Vol≦0.4V；Ioh=Iol=2mA Input：Vih≧0.7*VCC；Vil≦0.3*VCC
18	GPIO7	I/O	General Purpose I/O Pin	TTL Level； Output：Voh≧2.4V, Vol≦0.4V；Ioh=Iol=2mA Input：Vih≧0.7*VCC；Vil≦0.3*VCC
19	GPIO15	I/O	General Purpose I/O Pin	TTL Level； Output：Voh≧2.4V, Vol≦0.4V；Ioh=Iol=2mA Input：Vih≧0.7*VCC；Vil≦0.3*VCC
20	GPIO13	I/O	General Purpose I/O Pin	TTL Level； Output：Voh≧2.4V, Vol≦0.4V；Ioh=Iol=2mA Input：Vih≧0.7*VCC；Vil≦0.3*VCC

Definition Of Pin assignment

VCC DC Power Input

This is the main power supply for the Engine board. The power range is from 3.3V±10%, ripple ≤ 200mV. The maximum current of RGM-3000 is ≤ 200mA.

GND

GND provides the ground for the Engine board. Connect all grounds.

VBAT

This is the battery backup supply that powers the SRAM and RTC when main power is removed. The input voltage level is from 2.1V~3.6V. Max current draw is 10 uA at 3.3volt. Without an external backup battery or on board battery, engine board will execute a cold start after every turn on. To achieve the faster start-up offered by a hot or warm start, either a backup battery must be connected or battery installed on board.

TXA

This is the main transmit channel and is used to output navigation and measurement data to user written software. The default setup is NMEA Output, 4800bps, 8 data bits, no parity, 1 stop bit. The default sentences are GPGGA, GPGSA, GPRMC once per second and GPGSV once per 5 seconds.

Please refer to “software interface” for the detail protocol.

RXA

This is the main receiving channel and is used to receive software commands to the Engine board from user written software. Please refer to “software interface” for the detail protocol.

RXB

This is used for DGPS differential input .

BOOTSEL

Pull Bootsel pin high & reset , then it will get to boot mode.

GPIO

This pin can be programmed to input or output. For more application, please contact Royaltek’s sales.

Absolute maximum ratings

Parameter	Symbol	Unit	Min. Value	Max. Value
Supply voltage	VCC	V	2.97	3.63
Output current		MA		200

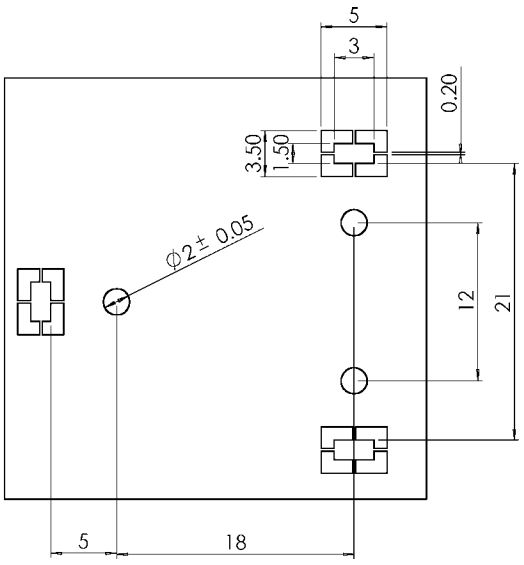
Critical design guide and diagram

1. It is recommanded to attach GNDu plate (30*30MM) below RGM3000 module or the antenna module of REB-3000XX02XX to increase the intensity of reception . Please refers to “Design Layout Diagram “ .

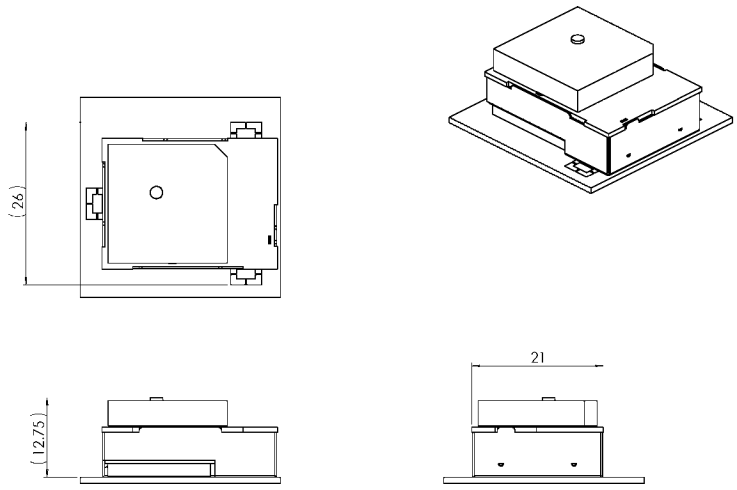
2. During design of integrated layout, please isolate high frequency noise source (power Switch,data or address signal lines) from GPS antenna.
3. Please don't place metal object above patch antenna.

Design Layout Diagram

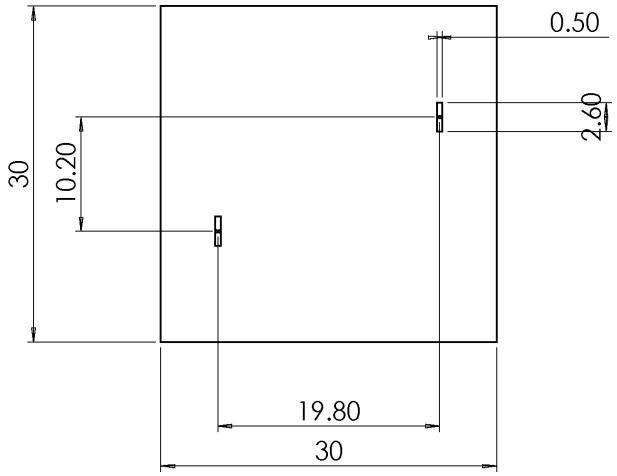
Recommanded Ground plate for RGM-3000XF00XX/REB-3000XFXXXX



RGM-3000XF00XX with ground plate



Recommanded REB-3000 Antenna Ground Plate



Connector tool (Option, not included in standard kit)

It is used to remove or install FPC on connector.

Software interface

NMEA V2.2 Protocol

It is the RS-232 interface:9600 bps, 8 bit data, 1 stop bit and no parity. It supports the following NMEA-0183 messages:GGA, GLL, GSA, GSV, RMC and VTG.

NMEA Output Messages

The Engine board outputs the following messages as shown in Table 1:

Table 1 NMEA-0183 Output Messages

NMEA Record	Description
GGA	Global positioning system fixed data
GLL	Geographic position – latitude / longitude
GSA	GNSS DOP and active satellites
GSV	GNSS satellites in view
RMC	Recommended minimum specific GNSS data
VTG	Course over ground and ground speed

GGA-Global Positioning System Fixed Data

Table 2 contains the values of the following

example: $GPGGA, 161229.487, 3723.2475, N, 12158.3416, W, 1, 07, 1.0, 9.0, M, , , ,0000*18

Table 2 GGA Data Format

Name	Example	Units	Description
Message ID	$GPGGA		GGA protocol header
UTC Position	161229.487		hhmmss.sss
Latitude	3723.2475		ddmm.mmmm
N/S Indicator	N		N=north or S=south
Longitude	12158.3416		dddmm.mmmm
E/W Indicator	W		E=east or W=west
Position Fix Indicator	1		See Table 2-1
Satellites Used	07		Range 0 to 12
HDOP	1.0		Horizontal Dilution of Precision
MSL Altitude	9.0	meters	
Units	M	meters	
Geoid Separation		meters	
Units	M	meters	
Age of Diff. Corr.		second	Null fields when DGPS is not used
Diff. Ref. Station ID	0000		
Checksum	*18		
<CR><LF>			End of message termination

Table 2-1 Position Fix Indicator

Value	Description
0	Fix not available or invalid
1	GPS SPS Mode, fix valid
2	Differential GPS, SPS Mode, fix valid
3	GPS PPS Mode, fix valid

GLL-Geographic Position – Latitude/Longitude

example:$GPGLL, 3723.2475, N, 12158.3416, W, 161229.487, A*2C

Table 3 contains the values of the following

Table 3 GLL Data Format

Name	Example	Units	Description
Message ID	$GPGLL		GLL protocol header
Latitude	3723.2475		ddmm.mmmm
N/S Indicator	N		N=north or S=south
Longitude	12158.3416		Dddmm.mmmm
E/W Indicator	W		E=east or W=west
UTC Position	161229.487		hhmmss.ss
Status	A		A=data valid or V=data not valid
Checksum	*2C		
<CR><LF>			End of message termination

GSA-GNSS DOP and Active Satellites

example:$GPGSA, A, 3, 07, 02, 26, 27, 09, 04, 15, , , , , , 1.8,1.0,1.5*33

Table 4 contains the values of the following

Table 4 GSA Data Format

Name	Example	Units	Description
Message ID	$GPGSA		GSA protocol header
Mode 1	A		See Table 4-2
Mode 2	3		See Table 4-1
Satellite Used	07		Sv on Channel 1
Satellite Used	02		Sv on Channel 2
….			….
Satellite Used			Sv on Channel 12
PDOP	1.8		Position Dilution of Precision
HDOP	1.0		Horizontal Dilution of Precision
VDOP	1.5		Vertical Dilution of Precision
Checksum	*33		
<CR><LF>			End of message termination

Table 4-1 Mode 1

Value	Description
1	Fix not available
2	2D
3	3D

Table 4-2 Mode 2

Value	Description
M	Manual-forced to operate in 2D or 3D mode
A	Automatic-allowed to automatically switch 2D/3D

GSV-GNSS Satellites in View

Table 5 contains the values of the following example: $GPGSV, 2, 1, 07, 07, 79, 048, 42, 02, 51, 062, 43, 26, 36, 256, 42, 27, 27, 138, 42*71$GPGSV, 2, 2, 07, 09, 23, 313, 42, 04, 19, 159, 41, 15, 12, 041, 42*41

Table 5 GSV Data Format

Name	Example	Units	Description
Message ID	$GPGSV		GSV protocol header
Number of Messages[1]	2		Range 1 to 3
Messages Number[1]	1		Range 1 to 3
Satellites in View	07		
Satellite ID	07		Channel 1(Range 1 to 32)
Elevation	79	degrees	Channel 1(Maximum 90)
Azimuth	048	degrees	Channel 1(True, Range 0 to 359)
SNR (C/No)	42	dBHz	Range 0 to 99, null when not tracking
….			….
Satellite ID	27		Channel 4(Range 1 to 32)
Elevation	27	degrees	Channel 4(Maximum 90)
Azimuth	138	degrees	Channel 4(True, Range 0 to 359)
SNR (C/No)	42	dBHz	Range 0 to 99, null when not tracking
Checksum	*71		
<CR><LF>			End of message termination

[1]Depending on the number of satellites tracked multiple messages of GSV data may be required.

RMC-Recommended Minimum Specific GNSS Data

Table 6 contains the values of the following example: $GPRMC, 161229.487, A, 3723.2475, N, 12158.3416, W, 0.13, 309.62, 120598, ,*10

Table 6 RMC Data Format

Name	Example	Units	Description
Message ID	$GPRMC		RMC protocol header
UTC Position	161229.487		hhmmss.sss
Status	A		A=data valid or V=data not valid
Latitude	3723.2475		ddmm.mmmm
N/S Indicator	N		N=north or S=south
Longitude	12158.3416		dddmm.mmmm
E/W Indicator	W		E=east or W=west
Speed Over Ground	0.13	knots	
Course Over Ground	309.62	degrees	True
Date	120598		ddmmyy
Magnetic Variation		degrees	E=east or W=west
Checksum	*10		
<CR><LF>			End of message termination

example:$GPVTG, 309.62, T, , M, 0.13, N, 0.2, K*6E

VTG-Course Over Ground and Ground Speed

Table 7 contains the values of the following

Table 7 VTG Data Format

Name	Example	Units	Description
Message ID	$GPVTG		VTG protocol header
Course	309.62	degrees	Measured heading
Reference	T		True
Course		degrees	Measured heading
Reference	M		Magnetic
Speed	0.13	knots	Measured horizontal speed
Units	N		Knots
Speed	0.2	km/hr	Measured horizontal speed
Units	K		Kilometer per hour
Checksum	*6E		
<CR><LF>			End of message termination

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GPS Receiver User's Tip

1. GPS signal will be affected by weather and environment conditions, thus suggest to use the GPS receiver under less shielding environments to ensure GPS receiver has better receiving performance.

2. When GPS receiver is moving, it will prolong the time to fix the position, so suggest to wait for the satellite signals to be locked at a fixed point when first power-on the GPS receiver to ensure to lock the GPS signal at the shortest time.

3. The following situation will affect the GPS receiving performance:
   a. Solar control filmed windows.
   b. Metal shielded, such as umbrella, or in vehicle.
   c. Among high buildings.
   d. Under bridges or tunnels.
   e. Under high voltage cables or near by radio wave sources, such as mobile phone base stations.
   f. Bad or heavy cloudy weather.
4. If the satellite signals can not be locked or encounter receiving problem (while in the urban area), the following steps are suggested:
   a. Please plug the external active antenna into GPS receiver and put the antenna on outdoor or the roof of the vehicle for better receiving performance.
   b. Move to another open space or reposition GPS receiver toward the direction with less blockage.
   c. Move the GPS receiver away from the interferences resources.
   d. Wait until the weather condition is improved.

5. While a GPS with a backup battery, the GPS receiver can fix a position immediately at next power-on if the build-in backup battery is full-recharged.